PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-050780
(43)Date of publication of application : 15.02.2002

(51)Int.Cl. H01L 31/04

(21)Application number : 2000-235296
(22)Date of filing : 03.08.2000

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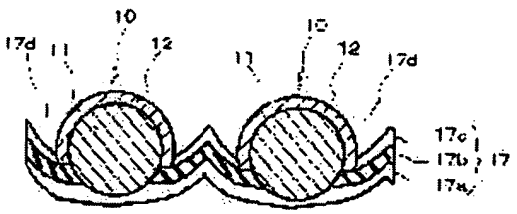
(54) SOLAR CELL AND METHOD OF MANUFACTURING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of manufacturing solar cell which can clear the process for formation of the inner electrode of the solar cell, formation of the outer electrode, and formation of an insulating layer between both electrodes with a single process, and is satisfactory in adhesion between a substrate and a spherical cell and high in reliability, and to provide the solar cell.
SOLUTION: This manufacturing process includes a process of preparing a substrate 17, where circular processing is applied to expose the two layers inside a three-layered structure, consisting of the first conductive layer 17a, an insulating layer 17b, and the second conductive layer 17c; a process of preparing a spherical cell 10 which is constituted by forming a second conductivity-type semiconductor layer 11, such that one part of a first conductivity-type semiconductor layer 11 is exposed, on the surface of the spherical substrate having the first conductivity-type semiconductor layer 11; and a process of electrically connecting the exposed section of the first conductivity-type semiconductor layer 11 with the first conductive layer 17a and electrically connecting a second conductivity-type semiconductor layer 12 with the second conductive layer 17c, and forming a recess 17d such that the substrate 17 is moved along the spherical cell 10 by placing the spherical cell 10, so that the section where the first conductivity-type semiconductor layer 11 is exposed of the spherical cell 10 abuts against the section, where circular processing is applied such that the two layers within the substrate 17 is exposed.



LEGAL STATUS

[Date of request for examination] 27.12.2002

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of

rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The process which prepares the substrate with which circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might be exposed, The process which prepares the sphere cel which forms the 2nd conductivity-type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which the 1st conductivity-type semi-conductor layer of said sphere cel exposed lays a sphere cel so that the bilayer inside said substrate may be exposed, and the part to which circular processing was performed may be contacted, and it arranges and pressurizes an elastic body under said substrate The part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are connected electrically. The manufacture approach of the solar battery characterized by including the process which forms a crevice so that said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate may be connected electrically and said substrate may meet said sphere cel.
[Claim 2] The process which prepares the substrate in which the crevice where circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might be exposed was formed, The process which prepares the sphere cel which forms the 2nd conductivity-type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which said 1st conductivity-type semi-conductor layer of said sphere cel exposed lays and pressurizes a sphere cel so that the crevice where circular processing was performed so that the bilayer inside said substrate might be exposed may be contacted The manufacture approach of the solar battery characterized by including the process to which the part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are electrically connected, and said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate are connected electrically.
[Claim 3] The substrate of the shape of a sheet which consists of three layer systems of the 1st conductive layer, an insulating layer, and the 2nd conductive layer possesses a crevice. The interior has the sphere cel which the 1st conductivity-type semi-conductor layer and a front face become from the 2nd conductivity-type semi-conductor layer in this crevice. The solar battery characterized by an inside electrode being formed and coming to form a ground electrode by connecting the 2nd conductivity-type semi-conductor layer of this sphere cel to the 2nd conductive layer and the electric target of said substrate by connecting the 1st conductivity-type semi-conductor layer of this sphere cel to the 1st conductive layer and the electric target of said substrate.
[Claim 4] The solar battery characterized by having an elastic body under said substrate in a solar battery according to claim 3.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a solar battery, and a solar battery, especially relates to the manufacture approach of a solar battery and solar battery using a sphere cel.
[0002]
[Description of the Prior Art] The electron and electron hole which were generated when the internal field has arisen into the pn junction part of a semi-conductor, light is applied to this and the electron-hole pair was made to generate are separated by the internal field, an electron is brought together in the n side, an electron hole is brought together in the p side, and if a load is connected outside, a current will flow towards the n side from the p side. This effectiveness is used and utilization of a solar battery is advanced as a component which transforms light energy into electrical energy.
[0003] In recent years, the technique of forming a circuit pattern on a spherical semi-conductor (Ball Semiconductor) with a diameter [of a single crystal, polycrystalline silicon, etc.] of 1mm or less, and manufacturing a semiconductor device is developed.
[0004] The manufacture approach of the solar array which connected many semi-conductor particles, using aluminum foil as one is proposed (JP,6-13633,A). By this approach, as shown in drawing 6 , the semi-conductor particle 207 which has n mold epidermis section and the interior of p mold is arranged so that it may project from the both sides of aluminum foil 201 in opening of aluminum foil, the epidermis section 209 of one side is removed, and an insulating layer 221 is formed. Next, the part inside [211] p mold and the insulating layer 221 on it are removed, and the 2nd aluminum foil 219 is combined with the removed field 217. The flat field 217 offers good ohmic contact to the 2nd aluminum foil 219 as a current carrying part.
[0005]
[Problem(s) to be Solved by the Invention] however, in such a conventional solar battery (the above-mentioned solar array) The electrode inside [211] p mold so that the electrode of the 2nd aluminum foil 201 and n mold epidermis section may be aluminum foil 201 and may not contact the aluminum foil of these two sheets The process which carries out alumite processing for the rear face of the aluminum foil 201 on top, and the process which coats insulating resin, such as polyimide, are needed. The number of production processes concerning formation of the inside electrode of a solar battery, formation of a ground electrode, and the insulating stratification between two electrodes increased dramatically, and there was a trouble that workability was not good etc. Moreover, since a gap (gap) existed between the aluminum foil of the two above-mentioned sheets, the sticking tendency with the aluminum foil used as the semi-conductor particle 207 and the substrate of a solar battery was bad, and there were troubles, like a problem arises in dependability.
[0006] This invention is accomplished in view of the above-mentioned trouble, can manufacture the process for [between formation of the inside electrode of a solar battery, formation of a ground electrode, and two electrodes] carrying out the insulating stratification at one process, and aims to let the sticking tendency of a substrate and a sphere cel offer the manufacture approach of a good reliable solar battery, and a solar battery.
[0007]
[Means for Solving the Problem] The process which prepares the substrate with which circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might expose the manufacture approach of the 1st solar battery of this invention, The process which prepares the sphere cel which forms the 2nd conductivity-

type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which the 1st conductivity-type semi-conductor layer of said sphere cel exposed lays a sphere cel so that the bilayer inside said substrate may be exposed, and the part to which circular processing was performed may be contacted, and it arranges and pressurizes an elastic body under said substrate The part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are connected electrically, said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate are connected electrically, and it is characterized by including the process which forms a crevice so that said substrate may meet said sphere cel. According to this approach, the junction process of the 1st conductivity-type semi-conductor layer of the sphere cel inside and the 1st conductive layer of a substrate, the insulation layer forming process between an inside electrode and a ground electrode, and the junction process of the 2nd conductivity-type (n mold) semi-conductor layer of a sphere cel outside and the electrode member (the 2nd conductive layer of a substrate) of a ground electrode can be manufactured at one process. Moreover, the crevice used as efficient condensing structure can be manufactured at the aforementioned process. Moreover, it can manufacture so that the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode may join directly, without minding a conductive paste etc., respectively.

[0008] The process which prepares the substrate in which the crevice where circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might expose the manufacture approach of the 2nd solar battery of this invention was formed, The process which prepares the sphere cel which forms the 2nd conductivity-type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which said 1st conductivity-type semi-conductor layer of said sphere cel exposed lays and pressurizes a sphere cel so that the crevice where circular processing was performed so that the bilayer inside said substrate might be exposed may be contacted It is characterized by including the process to which the part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are electrically connected, and said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate are connected electrically. According to this approach, the operation effectiveness by the manufacture approach of said 1st solar battery can be acquired, without using an elastic body.

[0009] The sheet-like substrate with which the 3rd solar battery of this invention consists of three layer systems of the 1st conductive layer, an insulating layer, and the 2nd conductive layer possesses a crevice. The interior has the sphere cel which the 1st conductivity-type semi-conductor layer and a front face become from the 2nd conductivity-type semi-conductor layer in this crevice. It is characterized by an inside electrode being formed and coming to form a ground electrode by connecting the 2nd conductivity-type semi-conductor layer of this sphere cel to the 2nd conductive layer and the electric target of said substrate by connecting the 1st conductivity-type semi-conductor layer of this sphere cel to the 1st conductive layer and the electric target of said substrate. Since the crevice in which the front face of a substrate was formed in accordance with the configuration of a sphere cel serves as efficient condensing structure to a sphere cel according to this configuration, the reflected light from the front face of a substrate can be used effectively. Moreover, the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode are joined directly, without minding a conductive paste etc., respectively, and low resistance-ization of a joint can be realized.

[0010] The 4th of this invention is characterized by having an elastic body under said substrate in a solar battery according to claim 3. According to this configuration, rear-face protection of a solar battery can be carried out with an elastic body.

[0011]

[Embodiment of the Invention] The gestalt of 1 operation is hereafter mentioned about the manufacture approach of of the solar battery and solar battery concerning this invention, and it explains to a detail with reference to a drawing.

[0012] As the solar battery concerning the operation gestalt of this invention shows an important section perspective view to drawing 1 , the substrate 17 of the shape of a sheet which consists of three layer systems of 1st conductive layer 17a, insulating-layer 17b, and 2nd conductive layer 17c has 17d of crevices, and it has the sphere cel 10 which turns into a cel of a solar battery inside 17d of this crevice.

[0013] The cross-section structure of a solar battery is explained in more detail. The cross section of the A-A line of drawing 1 is shown in drawing 2 . As shown in this drawing 2 , the sphere cel 10 which has the

internal p type semiconductor layer 11 (the 1st conductivity-type semi-conductor layer) and the n-type-semiconductor layer 12 (the 2nd conductivity-type semi-conductor layer) which forms pn junction It is stuck to the substrate 17 of the shape of a sheet which consists of three layer systems of 1st conductive layer 17a, insulating-layer 17b, and 2nd conductive layer 17c by pressure, and the internal p type semiconductor layer 11 and 1st conductive layer 17a of a substrate 17 are connected electrically. Thereby, 1st conductive layer 17a is the inside electrode of a solar battery. Moreover, it connects with the n-type-semiconductor layer 12 electrically, and 2nd conductive layer 17c has become the ground electrode of a solar battery.

[0014] Next, an example of the concrete manufacture approach of the solar battery concerning the operation gestalt of this invention is explained hereafter. First, an example of the formation approach of the sphere cel 10 used with the gestalt of this operation is explained. It is made to fall, heating p mold polycrystalline silicon grain with a diameter of 1mm in a vacuum, crystalline good p mold polycrystalline silicon ball (p type semiconductor layer) 11 is formed, and n mold polycrystalline silicon layer (n-type-semiconductor layer) 12 is formed in this front face with the CVD method using mixed gas, such as a silane containing phosphoretted hydrogen. A CVD process performs thin film formation here by carrying out supply blowdown of the gas heated by desired reaction temperature, conveying a silicon ball within a thin tube.

[0015] In addition, this process can also form n mold polycrystalline silicon layer (n-type-semiconductor layer) 12 by making desired gas contact on the way of [drop] while it spheroidizes making it fall heating p mold polycrystalline silicon grain in a vacuum and forms p mold polycrystalline silicon ball (p type semiconductor layer) 11.

[0016] Next, the manufacture approach of the solar battery using the above-mentioned sphere cel 10 is explained using drawing 3 , drawing 4 , and drawing 5 . Drawing 3 is an outline sectional view of a process on which a sphere cel is processed, and drawing 4 is the outline sectional view of the process which carries the processed sphere cel in a substrate and forms a solar battery. Drawing 5 is the outline perspective view of the substrate which consists of three layer systems.

[0017] The process which processes a sphere cel is explained using drawing 3 . First, the tray T which has the hollow prepared in order to vacate fixed spacing and to arrange a sphere cel in regular intervals in every direction is prepared. The outline sectional view of this tray T is shown in (a) of drawing 3 .

[0018] Next, as shown in (b) of drawing 3 , the sphere cel 10 is laid in the hollow of Tray T.

[0019] Next, as shown in (c) of drawing 3 , melting of the holddown member 13 which consists of a wax agent (for example, electron waxes, such as paraffin) is heated and carried out to melting temperature (in the case of paraffin, it is 100 degrees C - 200 degrees C), it slushes, and temperature is lowered and stiffened so that the sphere cel 10 may be buried.

[0020] Next, as shown in (d) of drawing 3 , the sphere cel 10 fixed by the holddown member 13 from Tray T is made into ejection and the reverse sense.

[0021] Next, as shown in (e) of drawing 3 , to the part in which the sphere cel 10 is not covered with a holddown member 13, by performing etching etc., the surface n-type-semiconductor layer 12 is removed, and the internal p type semiconductor layer 11 is exposed. Or the internal p type semiconductor layer 11 may be exposed by carrying out grinding of the part which is not covered with the above-mentioned holddown member 13 by grinding etc.

[0022] Next, the processed sphere cel is carried in a substrate and the process which forms a solar battery is explained using drawing 4 and drawing 5 . First, as shown in drawing 5 , it consists of 3 of 1st conductive layer 17a (for example, aluminum etc.), insulating-layer 17b (for example, insulator resin etc.), and 2nd conductive layer 17c (for example, aluminum etc.) layer systems, and the sheet-like substrate 17 with which circular processing was performed so that the bilayer whose part in which the sphere cel 10 is laid is the interior might be exposed is prepared.

[0023] Next, as shown in the outline sectional view of (a) of drawing 4 , alignment of the sphere cel 10 processed as mentioned above and the substrate 17 of the three above-mentioned layer systems is carried out, and it arranges so that the bottom of a substrate 17 may be covered with elastic bodies 14 (for example, elastomer etc.).

[0024] Next, the above-mentioned sphere cel 10, a substrate 17, and an elastic body 14 are piled up, and it heats at about 150 degrees C, and pressurizes from the upper part for about 1 hour using press equipment etc. By covering the lower part of a substrate 17 with an elastic body 14, in accordance with the configuration of the sphere cel 10, a substrate 17 deforms, 17d of crevices is formed, and it will be in the condition of (b) of drawing 4 . Next, sintering (sintering) processing is performed with the condition of having pressurized. As for 200 degrees C - 300 degrees C and application-of-pressure time amount, it is [whenever / stoving temperature / of this sintering (sintering) processing] desirable to carry out in an anoxia ambient atmosphere for 30 minutes to 1 hour.

[0025] Next, application of pressure is canceled and it removes by the same approach after cooling in the condition of having removed the holddown member 13 on top using heat or a chemical (for example, acetone), or having pressurized. This will be in the condition of (c) of drawing 4 .
[0026] Finally, an elastic body 14 is removed by a mechanical approach etc., the remnants which stuck further are removed using an organic solvent etc., and it will be in the condition of (d) of drawing 4 . Or it can also use as a rear-face protection sheet of a solar battery, without removing an elastic body 14. In this case, it is made to paste up with a substrate 17 using the elastic body 14 (elastomer) of the construction material out of which adhesiveness comes by heat treatment.
[0027] Moreover, beforehand, the substrate of the three above-mentioned layer systems can manufacture the solar battery of the gestalt of this operation at the same process by carrying out sphere cel installation and performing pressure treatment to this crevice, if a crevice is processed mechanically and formed in accordance with the configuration of a sphere cel.
[0028] In the gestalt of above-mentioned operation, although explained by using the 2nd conductivity type as n mold, having used the 1st conductivity type as p mold, n mold and the 2nd conductivity type can be similarly manufactured for the 1st conductivity type as a p mold. Moreover, although the sphere cel which uses p mold polycrystal as a spherical substrate was used, p mold single crystal or p mold amorphous silicon may be used.
[0029]
[Effect of the Invention] As a full account was given above, according to the manufacture approach of a solar battery and solar battery concerning this invention By having used the substrate of the shape of a sheet which consists of three layer systems of the 1st conductive layer, an insulating layer, and the 2nd conductive layer The junction process of the 1st conductivity-type (p mold) semi-conductor layer of the sphere cel inside, and the electrode member (the 1st conductive layer of a substrate) of an inside electrode, And the insulation layer forming process between an inside electrode and a ground electrode and the junction process of the 2nd conductivity-type (n mold) semi-conductor layer of a sphere cel outside and the electrode member (the 2nd conductive layer of a substrate) of a ground electrode can be manufactured at one process, and the production process of a solar battery can be simplified substantially. Moreover, since the crevice in which the front face of a substrate was formed in accordance with the configuration of a sphere cel serves as efficient condensing structure to a sphere cel, the reflected light from the front face of a substrate can be used effectively, and the effectiveness of the photo electric translation of a solar battery can be raised greatly. Moreover, since the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode are joined directly, without minding a conductive paste etc., respectively, low resistance-ization of a joint is realizable. Moreover, by heating, the insulating layer in a substrate (insulator resin) can have adhesiveness, and can strengthen immobilization in the substrate of a sphere cel more, and, therefore, the dependability of a solar battery can raise it more. Moreover, except for a sphere cel part, altogether, since it can form by the thin member, the solar battery of the shape of a sheet with the high degree of freedom of workability can be manufactured.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the manufacture approach of a solar battery, and a solar battery, especially relates to the manufacture approach of a solar battery and solar battery using a sphere cel.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The electron and electron hole which were generated when the internal field has arisen into the pn junction part of a semi-conductor, light is applied to this and the electron-hole pair was made to generate are separated by the internal field, an electron is brought together in the n side, an electron hole is brought together in the p side, and if a load is connected outside, a current will flow towards the n side from the p side. This effectiveness is used and utilization of a solar battery is advanced as a component which transforms light energy into electrical energy.
[0003] In recent years, the technique of forming a circuit pattern on a spherical semi-conductor (Ball Semiconductor) with a diameter [of a single crystal, polycrystalline silicon, etc.] of 1mm or less, and manufacturing a semiconductor device is developed.
[0004] The manufacture approach of the solar array which connected many semi-conductor particles, using aluminum foil as one is proposed (JP,6-13633,A). By this approach, as shown in drawing 6 , the semi-conductor particle 207 which has n mold epidermis section and the interior of p mold is arranged so that it may project from the both sides of aluminum foil 201 in opening of aluminum foil, the epidermis section 209 of one side is removed, and an insulating layer 221 is formed. Next, the part inside [211] p mold and the insulating layer 221 on it are removed, and the 2nd aluminum foil 219 is combined with the removed field 217. The flat field 217 offers good ohmic contact to the 2nd aluminum foil 219 as a current carrying part.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As a full account was given above, according to the manufacture approach of a solar battery and solar battery concerning this invention By having used the substrate of the shape of a sheet which consists of three layer systems of the 1st conductive layer, an insulating layer, and the 2nd conductive layer The junction process of the 1st conductivity-type (p mold) semi-conductor layer of the sphere cel inside, and the electrode member (the 1st conductive layer of a substrate) of an inside electrode, And the insulation layer forming process between an inside electrode and a ground electrode and the junction process of the 2nd conductivity-type (n mold) semi-conductor layer of a sphere cel outside and the electrode member (the 2nd conductive layer of a substrate) of a ground electrode can be manufactured at one process, and the production process of a solar battery can be simplified substantially. Moreover, since the crevice in which the front face of a substrate was formed in accordance with the configuration of a sphere cel serves as efficient condensing structure to a sphere cel, the reflected light from the front face of a substrate can be used effectively, and the effectiveness of the photo electric translation of a solar battery can be raised greatly. Moreover, since the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode are joined directly, without minding a conductive paste etc., respectively, low resistance-ization of a joint is realizable. Moreover, by heating, the insulating layer in a substrate (insulator resin) can have adhesiveness, and can strengthen immobilization in the substrate of a sphere cel more, and, therefore, the dependability of a solar battery can raise it more. Moreover, except for a sphere cel part, altogether, since it can form by the thin member, the solar battery of the shape of a sheet with the high degree of freedom of workability can be manufactured.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] however, in such a conventional solar battery (the above-mentioned solar array) The electrode inside [211] p mold so that the electrode of the 2nd aluminum foil 201 and n mold epidermis section may be aluminum foil 201 and may not contact the aluminum foil of these two sheets The process which carries out alumite processing for the rear face of the aluminum foil 201 on top, and the process which coats insulating resin, such as polyimide, are needed. The number of production processes concerning formation of the inside electrode of a solar battery, formation of a ground electrode, and the insulating stratification between two electrodes increased dramatically, and there was a trouble that workability was not good etc. Moreover, since a gap (gap) existed between the aluminum foil of the two above-mentioned sheets, the sticking tendency with the aluminum foil used as the semi-conductor particle 207 and the substrate of a solar battery was bad, and there were troubles, like a problem arises in dependability.
[0006] This invention is accomplished in view of the above-mentioned trouble, can manufacture the process for [between formation of the inside electrode of a solar battery, formation of a ground electrode, and two electrodes] carrying out the insulating stratification at one process, and aims to let the sticking tendency of a substrate and a sphere cel offer the manufacture approach of a good reliable solar battery, and a solar battery.

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MEANS

[Means for Solving the Problem] The process which prepares the substrate with which circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might expose the manufacture approach of the 1st solar battery of this invention, The process which prepares the sphere cel which forms the 2nd conductivity-type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which the 1st conductivity-type semi-conductor layer of said sphere cel exposed lays a sphere cel so that the bilayer inside said substrate may be exposed, and the part to which circular processing was performed may be contacted, and it arranges and pressurizes an elastic body under said substrate The part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are connected electrically, said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate are connected electrically, and it is characterized by including the process which forms a crevice so that said substrate may meet said sphere cel. According to this approach, the junction process of the 1st conductivity-type semi-conductor layer of the sphere cel inside and the 1st conductive layer of a substrate, the insulation layer forming process between an inside electrode and a ground electrode, and the junction process of the 2nd conductivity-type (n mold) semi-conductor layer of a sphere cel outside and the electrode member (the 2nd conductive layer of a substrate) of a ground electrode can be manufactured at one process. Moreover, the crevice used as efficient condensing structure can be manufactured at the aforementioned process. Moreover, it can manufacture so that the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode may join directly, without minding a conductive paste etc., respectively.
[0008] The process which prepares the substrate in which the crevice where circular processing was performed so that the bilayer inside three layer systems which consist of the 1st conductive layer, an insulating layer, and the 2nd conductive layer might expose the manufacture approach of the 2nd solar battery of this invention was formed, The process which prepares the sphere cel which forms the 2nd conductivity-type semi-conductor layer, and becomes as said a part of 1st conductivity-type semi-conductor layer was exposed to the sphere substrate front face which has the 1st conductivity-type semi-conductor layer, When the part which said 1st conductivity-type semi-conductor layer of said sphere cel exposed lays and pressurizes a sphere cel so that the crevice where circular processing was performed so that the bilayer inside said substrate might be exposed may be contacted It is characterized by including the process to which the part which said 1st conductivity-type semi-conductor layer exposed, and the 1st conductive layer of said substrate are electrically connected, and said 2nd conductivity-type semi-conductor layer and 2nd conductive layer of said substrate are connected electrically. According to this approach, the operation effectiveness by the manufacture approach of said 1st solar battery can be acquired, without using an elastic body.
[0009] The sheet-like substrate with which the 3rd solar battery of this invention consists of three layer systems of the 1st conductive layer, an insulating layer, and the 2nd conductive layer possesses a crevice. The interior has the sphere cel which the 1st conductivity-type semi-conductor layer and a front face become from the 2nd conductivity-type semi-conductor layer in this crevice. It is characterized by an inside electrode being formed and coming to form a ground electrode by connecting the 2nd conductivity-type semi-conductor layer of this sphere cel to the 2nd conductive layer and the electric target of said substrate by connecting the 1st conductivity-type semi-conductor layer of this sphere cel to the 1st conductive layer and the electric target of said substrate. Since the crevice in which the front face of a substrate was formed in accordance with the configuration of a sphere cel serves as efficient condensing

structure to a sphere cel according to this configuration, the reflected light from the front face of a substrate can be used effectively. Moreover, the p type semiconductor layer of the sphere cel inside, the electrode member of an inside electrode, and the n-type-semiconductor layer of a sphere cel outside and the electrode member of a ground electrode are joined directly, without minding a conductive paste etc., respectively, and low resistance-ization of a joint can be realized.

[0010] The 4th of this invention is characterized by having an elastic body under said substrate in a solar battery according to claim 3. According to this configuration, rear-face protection of a solar battery can be carried out with an elastic body.

[0011]

[Embodiment of the Invention] The gestalt of 1 operation is hereafter mentioned about the manufacture approach of of the solar battery and solar battery concerning this invention, and it explains to a detail with reference to a drawing.

[0012] As the solar battery concerning the operation gestalt of this invention shows an important section perspective view to drawing 1 , the substrate 17 of the shape of a sheet which consists of three layer systems of 1st conductive layer 17a, insulating-layer 17b, and 2nd conductive layer 17c has 17d of crevices, and it has the sphere cel 10 which turns into a cel of a solar battery inside 17d of this crevice.

[0013] The cross-section structure of a solar battery is explained in more detail. The cross section of the A-A line of drawing 1 is shown in drawing 2 . As shown in this drawing 2 , the sphere cel 10 which has the internal p type semiconductor layer 11 (the 1st conductivity-type semi-conductor layer) and the n-type-semiconductor layer 12 (the 2nd conductivity-type semi-conductor layer) which forms pn junction It is stuck to the substrate 17 of the shape of a sheet which consists of three layer systems of 1st conductive layer 17a, insulating-layer 17b, and 2nd conductive layer 17c by pressure, and the internal p type semiconductor layer 11 and 1st conductive layer 17a of a substrate 17 are connected electrically. Thereby, 1st conductive layer 17a is the inside electrode of a solar battery. Moreover, it connects with the n-type-semiconductor layer 12 electrically, and 2nd conductive layer 17c has become the ground electrode of a solar battery.

[0014] Next, an example of the concrete manufacture approach of the solar battery concerning the operation gestalt of this invention is explained hereafter. First, an example of the formation approach of the sphere cel 10 used with the gestalt of this operation is explained. It is made to fall, heating p mold polycrystalline silicon grain with a diameter of 1mm in a vacuum, crystalline good p mold polycrystalline silicon ball (p type semiconductor layer) 11 is formed, and n mold polycrystalline silicon layer (n-type-semiconductor layer) 12 is formed in this front face with the CVD method using mixed gas, such as a silane containing phosphoretted hydrogen. A CVD process performs thin film formation here by carrying out supply blowdown of the gas heated by desired reaction temperature, conveying a silicon ball within a thin tube.

[0015] In addition, this process can also form n mold polycrystalline silicon layer (n-type-semiconductor layer) 12 by making desired gas contact on the way of [drop] while it spheroidizes making it fall heating p mold polycrystalline silicon grain in a vacuum and forms p mold polycrystalline silicon ball (p type semiconductor layer) 11.

[0016] Next, the manufacture approach of the solar battery using the above-mentioned sphere cel 10 is explained using drawing 3 , drawing 4 , and drawing 5 . Drawing 3 is an outline sectional view of a process on which a sphere cel is processed, and drawing 4 is the outline sectional view of the process which carries the processed sphere cel in a substrate and forms a solar battery. Drawing 5 is the outline perspective view of the substrate which consists of three layer systems.

[0017] The process which processes a sphere cel is explained using drawing 3 . First, the tray T which has the hollow prepared in order to vacate fixed spacing and to arrange a sphere cel in regular intervals in every direction is prepared. The outline sectional view of this tray T is shown in (a) of drawing 3 .

[0018] Next, as shown in (b) of drawing 3 , the sphere cel 10 is laid in the hollow of Tray T.

[0019] Next, as shown in (c) of drawing 3 , melting of the holddown member 13 which consists of a wax agent (for example, electron waxes, such as paraffin) is heated and carried out to melting temperature (in the case of paraffin, it is 100 degrees C - 200 degrees C), it slushes, and temperature is lowered and stiffened so that the sphere cel 10 may be buried.

[0020] Next, as shown in (d) of drawing 3 , the sphere cel 10 fixed by the holddown member 13 from Tray T is made into ejection and the reverse sense.

[0021] Next, as shown in (e) of drawing 3 , to the part in which the sphere cel 10 is not covered with a holddown member 13, by performing etching etc., the surface n-type-semiconductor layer 12 is removed, and the internal p type semiconductor layer 11 is exposed. Or the internal p type semiconductor layer 11 may be exposed by carrying out grinding of the part which is not covered with the above-mentioned holddown member 13 by grinding etc.

[0022] Next, the processed sphere cel is carried in a substrate and the process which forms a solar battery is explained using drawing 4 and drawing 5 . First, as shown in drawing 5 , it consists of 3 of 1st conductive layer 17a (for example, aluminum etc.), insulating-layer 17b (for example, insulator resin etc.), and 2nd conductive layer 17c (for example, aluminum etc.) layer systems, and the sheet-like substrate 17 with which circular processing was performed so that the bilayer whose part in which the sphere cel 10 is laid is the interior might be exposed is prepared.
[0023] Next, as shown in the outline sectional view of (a) of drawing 4 , alignment of the sphere cel 10 processed as mentioned above and the substrate 17 of the three above-mentioned layer systems is carried out, and it arranges so that the bottom of a substrate 17 may be covered with elastic bodies 14 (for example, elastomer etc.).
[0024] Next, the above-mentioned sphere cel 10, a substrate 17, and an elastic body 14 are piled up, and it heats at about 150 degrees C, and pressurizes from the upper part for about 1 hour using press equipment etc. By covering the lower part of a substrate 17 with an elastic body 14, in accordance with the configuration of the sphere cel 10, a substrate 17 deforms, 17d of crevices is formed, and it will be in the condition of (b) of drawing 4 . Next, sintering (sintering) processing is performed with the condition of having pressurized. As for 200 degrees C - 300 degrees C and application-of-pressure time amount, it is [whenever / stoving temperature / of this sintering (sintering) processing] desirable to carry out in an anoxia ambient atmosphere for 30 minutes to 1 hour.
[0025] Next, application of pressure is canceled and it removes by the same approach after cooling in the condition of having removed the holddown member 13 on top using heat or a chemical (for example, acetone), or having pressurized. This will be in the condition of (c) of drawing 4 .
[0026] Finally, an elastic body 14 is removed by a mechanical approach etc., the remnants which stuck further are removed using an organic solvent etc., and it will be in the condition of (d) of drawing 4 . Or it can also use as a rear-face protection sheet of a solar battery, without removing an elastic body 14. In this case, it is made to paste up with a substrate 17 using the elastic body 14 (elastomer) of the construction material out of which adhesiveness comes by heat treatment.
[0027] Moreover, beforehand, the substrate of the three above-mentioned layer systems can manufacture the solar battery of the gestalt of this operation at the same process by carrying out sphere cel installation and performing pressure treatment to this crevice, if a crevice is processed mechanically and formed in accordance with the configuration of a sphere cel.
[0028] In the gestalt of above-mentioned operation, although explained by using the 2nd conductivity type as n mold, having used the 1st conductivity type as p mold, n mold and the 2nd conductivity type can be similarly manufactured for the 1st conductivity type as a p mold. Moreover, although the sphere cel which uses p mold polycrystal as a spherical substrate was used, p mold single crystal or p mold amorphous silicon may be used.

[Translation done.]

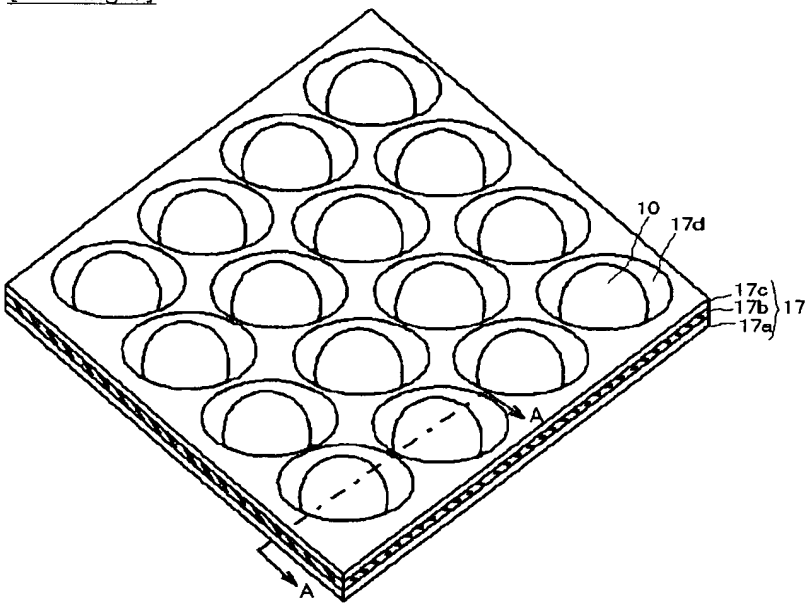
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the important section perspective view of the solar battery concerning the operation gestalt of this invention.
[Drawing 2] It is a cross-section schematic diagram explaining the solar battery concerning the operation gestalt of this invention.
[Drawing 3] It is a cross-section schematic diagram explaining the processing process of the sphere cel of the manufacture approach of the solar battery concerning the operation gestalt of this invention.
[Drawing 4] It is the outline sectional view of the process which carries in a substrate the sphere cel which the manufacture approach of the solar battery concerning the operation gestalt of this invention processed, and forms a solar battery.
[Drawing 5] It is the outline perspective view of the substrate of three layer systems concerning the operation gestalt of this invention.
[Drawing 6] It is a cross-section schematic diagram explaining the conventional solar battery.
[Description of Notations]
10 Sphere Cel
11 1st Conductivity-Type (P Mold) Semi-conductor Layer
12 2nd Conductivity-Type (N Mold) Semi-conductor Layer
13 Holddown Member
14 Elastic Body
17 Substrate
17a The 1st conductive layer
17b Insulating layer
17c The 2nd conductive layer
17d Crevice

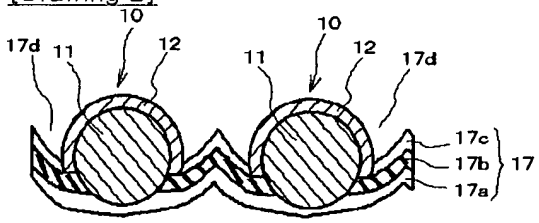
[Translation done.]

DRAWINGS

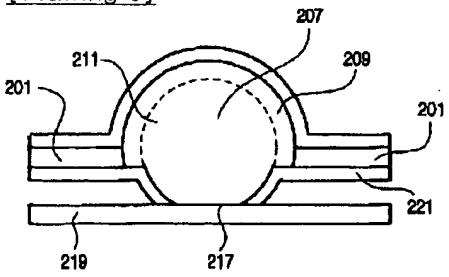
[Drawing 1]



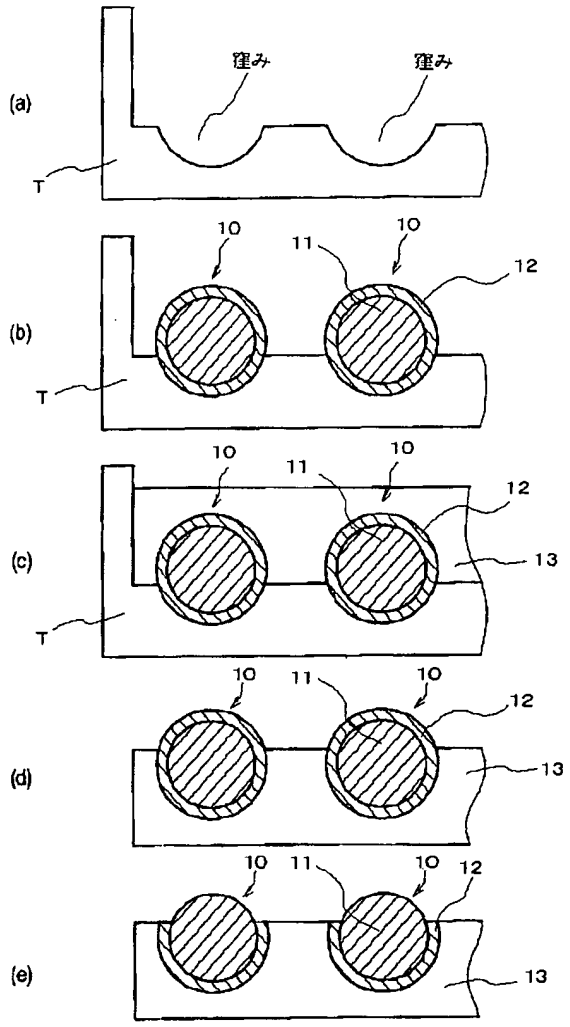
[Drawing 2]



[Drawing 6]



[Drawing 3]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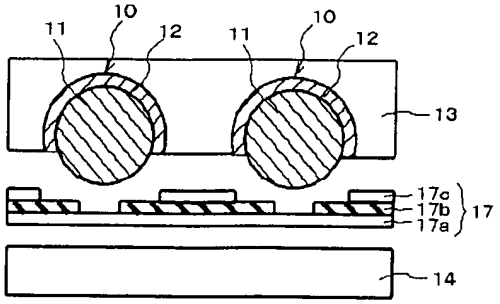
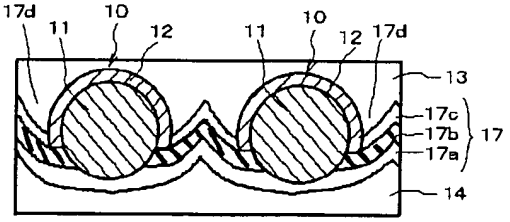
(e)

[Drawing 4]

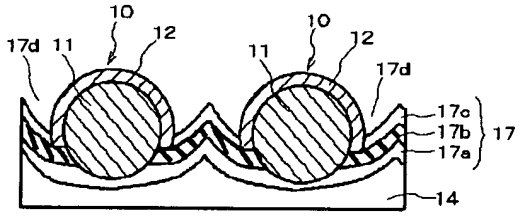
(a)



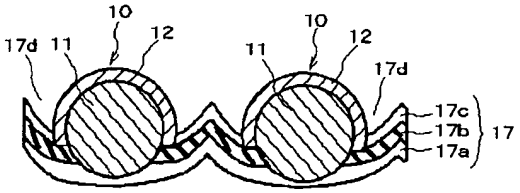
(b)



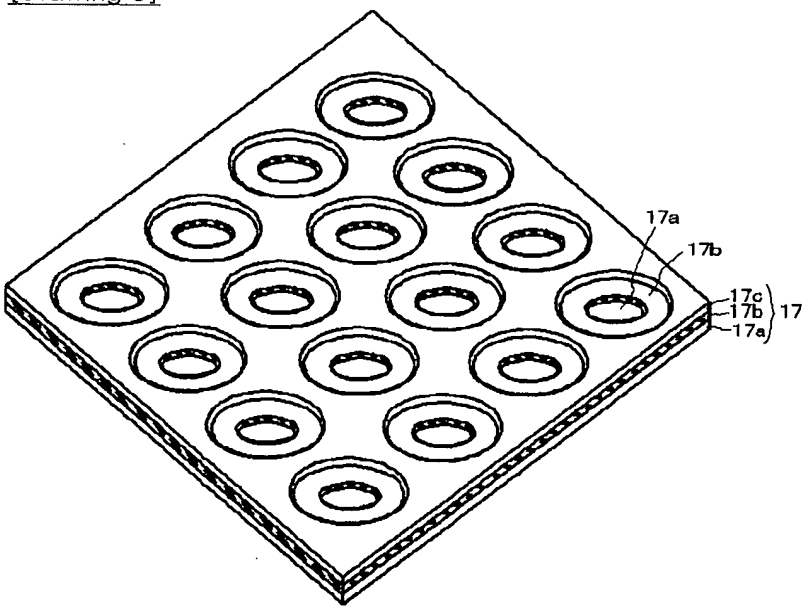
(c)



(d)



[Drawing 5]



[Translation done.]